PORTABLE TERMINAL

TECHNICAL FIELD

The present invention relates to a portable terminal apparatus such as a portable telephone which can be carried by a person. More specifically, the present invention is directed to a portable terminal apparatus equipped with a GPS receiving unit for receiving GPS signals transmitted from GPS (Global Positioning System) satellites so as to acquire positional information.

BACKGROUND ART

Recently, in automobile navigation systems, positional information providing functions have been provided by which GPS signals transmitted from GPS satellites are received so as to acquire positional information of the own navigation systems and to indicate present positions on maps. Very recently, even in portable terminal apparatus such as portable telephones, such notification services as positional information and time instants may be provided by utilizing the GPS satellites.

Since GPS signals are employed, correct positional information such as latitude/longitude as to present positions may be acquired in higher precision. However, in such a case that a user travels by receiving only such GPS signals, the user cannot grasp that this traveling user is presently directed to which direction. In order to increase an additional value of positional information services provided in portable terminal apparatus, similar to automobile navigation systems, such a function is desirably employed. That is, while a geomagnetic sensor is employed so as to also acquire azimuth information, a map is rotated to be displayed in conjunction with such a direction to which a user is presently directed when a present position is displayed on the map.

However, as previously explained, in the case that a geomagnetic sensor is provided in a portable terminal apparatus so as to acquire azimuth information, there is such a risk that the geomagnetic sensor is adversely influenced by magnetic fields generated from other components, and thus, cannot correctly sense the geomagnetism. Since a large number of components for generating magnetic noise such as a speaker are mounted within the portable terminal apparatus, and furthermore, the respective mounted components are provided in the vicinity of each other so as to make this portable terminal apparatus compact, this geomagnetic sensor is brought into such a condition that the geomagnetic sensor may be adversely and readily influenced by magnetic noise. Also, while the portable terminal apparatus is carried by the user, another adverse influence caused by externally-applied magnetization must be considered. As a consequence, in order to achieve stable performance of the geomagnetic sensor, both a component arrangement and a structure, capable of avoiding an adverse influence caused by peripheral magnetic fields other than the geomagnetism, must be employed, so that designing of these component arrangement and structure is largely restricted.

In this case, FIG. **8** and FIG. **9** shows a structural example of a portable terminal apparatus equipped with both a GPS receiving unit and a geomagnetic sensor. This structural example indicates such a construction which is applied to a portable telephone arranged in that both a first housing **101** and a second housing **102** can be folded at a hinge portion **103**. As indicated in FIG. **8**(A), a GPS receiving unit **105** is provided on the first housing **101**. The GPS receiving unit **105** is equipped with both a GPS antenna and a receiving

circuit, which may receive a GPS signal **121** transmitted from a GPS satellite **120** so as to acquire positional information of the own portable telephone. Also, a geomagnetic sensor **107** for sensing geomagnetism is provided on a circuit board **32** in the second housing **102**. The circuit board **106** mounts thereon a high frequency circuit, a baseband circuit, a control circuit, and the like, and is stored in this second housing **102**. As this geomagnetic sensor **107**, such a sensor is employed which is equipped with magnetic field detecting capabilities for two-axial components of the horizontal direction. Based upon the positional information acquired by the above-explained GPS receiving unit **105** and the azimuth information acquired by the geomagnetic sensor **107**, the positional information and a time instant may be displayed on the display unit **108** in combination with a map.

Also, a speaker **109** is provided as a built-in component in the second housing **102** in the vicinity of the geomagnetic sensor **107**, while this speaker **109** produces ringing sound (telephone calling sound), and the like. Magnetic noise radiated from a magnet **109***a* of this speaker **109** is expressed by a magnetic force line **110**. As indicated in FIG. **8**(B), a tangential vector **111** of the magnetic force line **110** radiated from the speaker **109** with respect to the geomagnetic sensor **107** contains both a vertical-direction component **111***a* and a horizontal-direction component **111***b* of the magnetic force line. As a consequence, the geomagnetic sensor **107** may sense this horizontal-direction component **111***b* of the magnetic force line **110**, and thus, there is such a problem that the geomagnetic sensor **107** may produce errors in the geomagnetic detecting operation by receiving the adverse influence of the peripheral magnetic force, and cannot correctly sense the geomagnetism.

To cancel the adverse influence caused by this peripheral magnetic force, the arranging construction must be changed, for instance, such a component for giving an adverse influence to the geomagnetic sensor is separated from this geomagnetic sensor. Also, a correcting function by way of software must be provided. Alternatively, such a function capable of de-energizing the magnetic noise other than the geomagnetism must be mounted. Since such a means is employed, various problems may occur, for example, the above-described arranging construct can be hardly employed in the actual apparatus, and the apparatus becomes bulky and complex. Thus, such a means can be hardly applied to portable terminal apparatus.

Also, as represented in FIG. **9**, in such a structural case that an antenna **115** is provided on the side of the second housing **102**, when the portable telephone is put on a desk **125**, a bottom plane (namely, plane on the outer side) of the second housing **102** cannot become flat, so that the geomagnetic sensor **107** provided inside the second housing **102** is inclined with respect to the horizontal plane. When the geomagnetic sensor **107** is inclined at an angle larger than, or equal to a predetermined angle, an error may occur in the geomagnetic detecting operation. In particular, when the geomagnetic sensor **107** is adjusted (calibrated) prior to the geomagnetic detecting operation, if the geomagnetic sensor **107** is inclined, then there is such a problem that the adjustment of the geomagnetic sensor **107** cannot be correctly carried out but the sensing precision of the geomagnetism is lowered.

The present invention has been made to solve the above-described problems, and therefore, has an object to provide a portable terminal apparatus capable of detecting geomagnetism in higher precision and capable of acquiring correct azimuth information, while eliminating an adverse influence